Sensor-Enabled Geogrids for Health Monitoring of Reinforced Soil Structures

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Monitoring performance of reinforced earthen structures can help to identify areas of serviceability problems and take timely measures against impending failures. It also helps with detecting signs of excessive deformation and other problems caused by unpredicted site conditions or other factors during construction. Therefore, it can also facilitate making timely adjustments to complete the construction procedure successfully. The analysis of data collected from performance monitoring of reinforced soil structures will also help to develop improved design guidelines and construction methods. This paper reports the latest developments in the sensor-enabled geogrids (SEGG) technology, which has recently been introduced as a special category of geogrid products with embedded deformation-sensing capability in addition to the conventional reinforcement/stabilization function for earthen structures. In this technology, the strain-sensing function of modified geogrids (SEGG products) originates from strain sensitivity in the electrical conductivity of one or more constituent polymers that are filled with a target concentration of conductive fillers. The formulation developed in this study to make a conductive coating composite for SEGG is presented. The results of a series of laboratory tests on SEGG specimens are discussed that were made of polyethylene terephthalate (polyester) yarns coated with a strain sensitive carbon black-filled PVC composite. The influence of confining pressure (for in-soil applications of SEGG) and the loading rate on the strain sensitivity and tensile strength of SEGG specimens are also studied. Results of the study show that the SEGG technology holds promise to serve as an alternative to conventional instruments for performance monitoring of earthen structures.

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